Introduction to ACI/CRSI Adhesive Anchor Installer Certification Program

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Adhesive Anchor Installation...

Seems Simple Enough?
Massachusetts Turnpike Authority

Adhesive Anchor Installation...
Seems Simple Enough? Right?
Drill
Drill, Clean
Drill, Clean, Inject
Drill, Clean, Inject, Install
Massachusetts Turnpike Authority

Drill, Clean, Inject, Install, Protect...
Simple Enough?
Drill, Clean, Inject, Install, Protect...
Simple Enough?  Don’t bet on it.
A Field Study of Adhesive Anchor Installations

- Concrete International, January 2011
For every fastening application, the starting point is choosing the correct product. This requires understanding the loads to be resisted and following a defined design method. It also requires establishing the exact location of the fixing point, anticipating the environmental conditions during installation and service, and knowing the installation procedures for the fastener or anchor.

For adhesive anchors, the designer must select a product that is adequate for the conditions in service and that has been evaluated for compliance with code requirements.

Once an appropriate system has been selected and designed, the installation process has to be considered. To ensure correct installation, the installer must follow the manufacturer’s instructions precisely. Furthermore, the installer must follow the requirements of the relevant evaluation service report (ESR)—refer to the sidebar. Detailed information on the installation and inspection of adhesive anchors is given by Wollmershauser and Mattis, and information on factors influencing the behavior of adhesive anchors can be found in Reference 2.

In theory, the knowledge is available to ensure reliable fastenings with adhesive anchors and to give designers and installers confidence and flexibility in myriad applications. With the failure of adhesive anchors in Boston, MA, however, the installation and use of these types of anchors has been called into question. To figure out what can be improved with regard to the use of adhesive anchors, adhesive anchor installations with injection systems were monitored on 23 job sites in five locations scattered over the U.S. Critical aspects were examined to determine gaps between actual and recommended practice and to come up with proposals to improve installation practices.

**FIELD RESEARCH PROJECT**

The installation of adhesive anchor systems was investigated at construction sites in California, Florida, Illinois, New York, and Pennsylvania. In total, 23 sites were visited, 26 applications were monitored, and 31 installers were interviewed (Table 1). Thirteen different adhesive systems (either epoxy-based or hybrid mortars) were installed. Nine of these products had an ESR. The steel anchors were continuously threaded steel rods or deformed steel reinforcing bars. Anchors were used for strengthening bridge structures, seismic retrofits, connecting structural elements to structural walls, anchoring steel elements to existing concrete members, anchoring pavement dowels, installing hurricane protection, or anchoring façade elements. The anchors were installed downward in 13 applications, horizontally in 11 applications, and overhead in two applications.

**TABLE 1: DETAILS OF THE SURVEY**

<table>
<thead>
<tr>
<th>Location</th>
<th>Job sites</th>
<th>Applications</th>
<th>Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Florida</td>
<td>7</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>California</td>
<td>5</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>New York</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>23</td>
<td>26</td>
<td>31</td>
</tr>
</tbody>
</table>
A Field Study of Adhesive Anchor Installations

- Job Sites
- 23 Total
A Field Study of Adhesive Anchor Installations

Applications

- MPIIs Available on Site
- MPIIs Used
- Expiration Date Exceeded

0 3 6 9 12 15 18 21 24 27
A Field Study of Adhesive Anchor Installations

- Was drill bit size per MPIIs?
A Field Study of Adhesive Anchor Installations

- Was drill bit size per MPIIs?

- No - too large (23%)
- No - too small (15%)
- Yes (38%)
- No Info (23%)
A Field Study of Adhesive Anchor Installations

- Was drill hole cleaned per the MPIIs?
A Field Study of Adhesive Anchor Installations

- Was drill hole cleaned per the MPIIs?

- No: 77%
- Yes: 19%
- 4%
A Field Study of Adhesive Anchor Installations

- Was mortar dispensed prior to injection?
A Field Study of Adhesive Anchor Installations

- Was mortar dispensed prior to injection?

- Not Observed: 15%
- Yes: 31%
- No: 54%
Video: Why the Program?

(click next to start)
American Concrete Institute

Video: Why the Program?
“Big Dig” accident in 2006, one dead
17TH STREET BRIDGE CANOPY FAILURE INVESTIGATION

Atlanta, Georgia
Canopy Failure

- Approximately 7 years after construction
- 190 ft. long section of canopy-fence detached from south parapet and fell onto roadway below
Visual Assessment – Anchor Holes

- Epoxy observations
  - Generally bonded to substrate concrete
  - Frequent voids/air pockets, especially in back 1.5” of hole
  - Varied in color
    - Opaque dark gray
    - Opaque light gray
    - Translucent brown
  - Wet epoxy components extracted at 3 locations

[Image: Wet epoxy component extracted from inside hole 56B]
Visual Assessment of Anchor Holes

- Videoscope observations
Laboratory Observations
Japan Sasago Tunnel

❖ Ceiling Panel Collapse
❖ December 2, 2012
Japan Sasago Tunnel
9 dead
ACI’s Response to NTSB Recommendations

As part of our overall response ACI...

❖ Partnered with the Concrete Reinforcing Steel Institute (CRSI) to identify criteria for an Adhesive Anchor Installer and develop a certification program

❖ Fast Track of a new document for Adhesive Anchors ACI 355.4 “Acceptance Criteria for Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary (Provisional Standard)”

❖ Change in 318-11 Building Code, Address Adhesive Anchors
Why do we need Certification?
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ACI Alaska AAI Program

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